Doc. No. 033-600011
Cage Code: 9M715
REV. A
February 21, 2001

DAS Data Requirement 19

Demand Access System (DAS) Integrated Logistics Support Plan (ILSP)

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CHANGE RECORD

Revision	Description	Date	Approved
-	Released per ECF – AQ0011	10/24/00	W.E. Kearns
A	Released per ECF – AQ0030	2/21/2001	W.E. Kearns

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1. SCOPE

1.1 IDENTIFICATION

This Integrated Logistics Support Plan (ILSP) describes the management structure, tools and reporting required for the implementation, integration and execution of the Demand Access System (DAS) Integrated Logistics Support program. This plan includes the ILS organization, maintenance concepts and sparing quantities required for continuous operation over the system's 10-year life cycle. Supporting assumptions, analyses and methodologies are described, as appropriate.

This analysis is submitted to fulfill the requirements of Deliverable Requirements List (DRL) 19 in conjunction with the performance of the DAS contract.

1.2 SYSTEM OVERVIEW

The purpose of the DAS is to expand existing Tracking and Data Relay Satellite system (TDRSS) Multiple Access Return (MAR) capabilities. The DAS will build upon the Third Generation Beamformer Subsystem (TGBFS) development by adding global system control and coordination functions and data distribution capabilities.

The approach of the DAS product development and deployment is to establish a basic operational infrastructure. The basic infrastructure will consist of all the control/monitoring, switching and data storage capabilities to facilitate expansion of beamforming and data demodulation. The initial infrastructure will have a single beamforming group (IBUG) and demodulator group (DMG) for each of the three TDRS regions. Two IBUG/Demodulator groups will be installed at the White Sands Ground Terminal (WSGT) in New Mexico and one at the Guam Remote Ground Terminal (GRGT). The full operational capability will include ten IBUGs and eight DMGs at White Sands and in Guam to service a maximum of fifty customer data streams at each location. At the conclusion of the DAS product development, the DMGs are expected to become COTS items.

1.3 APPLICABLE DOCUMENTS

1.3.1 Program Documents

450-PG-8700.2.2A	Systems Management Plan, Paragraph 4.2.2
451-DAS-SRD	DAS System Requirements Document
035-600010	DAS RMA Analysis Report
NHB 6000.1D	Handling, Storage, Packaging, Marking, Preservation, and Transportation
STDN 507	Space Network Logistics Manual

1.3.2 Reference Documents

MIL-HDBK-217	Reliability Prediction of Electronic Equipment
MIL-HDBK-470	Designing and Developing Maintainable Products and Systems
MIL-HDBK-472	Maintainability Prediction
MIL-STD-756	Reliability Modeling and Prediction
MIL-STD-785	Reliability Program for System and Equipment, Development and Production
NPD 7500.1	Program and Project Logistics Policy

2. ORGANIZATION

2.1 GOVERNMENT ORGANIZATION

2.1.1 Government Management Responsibilities

The NASA DAS Program Management Plan describes and documents the organization, methodology and tools to be used in managing the DAS program. DAS Product Management activities are defined to ensure the performance of all management functions necessary for delivery of the DAS product. Examples of management activities are to direct and control system definition, design development, and validation of the system. The NASA Space Network (GSFC Code 453) organization and responsibilities are described in the SN Program Plan (541-PG-7120.2.1A).

2.1.2 Government Logistics Responsibilities

The WSC has the resources, personnel, and logistics support required to (1) maintain, modify, and repair hardware and (2) maintain modify and enhance software. Hardware maintenance is performed under a formally established system maintenance program that includes both Preventive Maintenance and Corrective Maintenance procedures.

WSGT and GRGT personnel will be required to:

- Monitor system status and health.
- Report faults and failures in an appropriate manner.
- Provide Level 1 and Level 2 maintenance duties, as defined in the DAS Operations and Maintenance Manual.
- Maintain storage of spares.
- Manage parts in accordance with defined procedures.

2.2 CONTRACTOR ORGANIZATION

2.2.1 ITT Management Responsibilities

The DAS hardware and software will be developed, integrated and deployed by ITT Advanced Engineering and Sciences. Training and O&M manual development will be provided by ITT. The ITT DAS Program Management Plan describes and documents the ITT organization, methodology and tools to be used in managing the DAS program. It also defines the Contract Work Breakdown Structure established to plan, control, and measure all program activities and the master milestone schedule and deliverables for accomplishing the program objectives.

NASA's WSC O&M contractor will install and test DAS at White Sands and Guam. ITT will support these efforts, overseeing installation and site testing activities. NASA's Space Network Web Based Services Interface (SWSI) Project Team will develop the planning and scheduling interface for DAS customers. When completed, SWSI will act as the interface point for DAS Customers. ITT will support the SWSI project team, developing a DAS-SWSI ICD governing the exchange of data between DAS and SWSI.

2.2.2 ITT Logistics Responsibilities

ITT will develop and deliver an O&M manual to the Government in accordance with the DAS DID/DRL No. 17 and a Training Plan and Materials in accordance with DAS DID/DRL 18. ITT will also provide technical services to support the operations and maintenance of the DAS after delivery, including:

- Operational training for WSC and Guam ground station personnel as designated by the Government.
- Level 2 hardware and software maintenance training for WSC ground station personnel as designated by the Government.

2.2.3 Additional Contractor Logistics Responsibilities

Other NASA Contractors have the collective responsibility to perform the following logistics activities:

- Develop and implement a sound ILS program.
- Provide logistics support to the DAS product effort including provision of spare mechanical and electronic parts and the procurement of equipment and materials necessary to support operation and maintenance functions.
- Provide Level 2 Maintenance/Depot repair of failed components.
- Provide spares replenishment, as requested by NASA, according to cost and schedule constraints.
- Maintain failure data to determine future spares availability.

2.2.4 Schedule of ILS Activities

Table 2-1 summarizes the major ILS activities for the DAS program. Completion dates are the currently scheduled deadlines proposed for the listed activities. Dates are subject to modification based on the availability of WSC and GRGT personnel, resources and other conflicting high priority, operational events, such as shuttle launches. Scheduled event details are provided in the Baseline DAS Schedule (DRL No. 4).

Table 2-1: Major ILS Activities

Activity	Completion/Performance Dates
Site Preparation and Installation Plan Complete	12/12/01
System Acceptance Test Plans and Procedures Complete	9/25/01
Operations and Maintenance Manual Complete	12/12/01
Training Plan and Materials Complete	12/12/01
CSOC Installation Plan and Schedule Engineering Change Closure Complete	5/23/02
Factory Acceptance Testing	1/3/02 - 1/28/02
Ship Equipment to WSC	1/29/02 – 2/4/02
Install Equipment at WSC	2/5/02 – 2/11/02
Ship Equipment to GRGT	1/29/02 – 2/4/02
Install Equipment at GRGT	2/26/02 – 3/6/02
WSC Site Acceptance Testing	2/12/02 – 2/18/02
GRGT Site Acceptance Testing	3/7/02 – 3/13/02
WSC and GRGT End-to-End Testing	3/25/02 – 3/29/02
WSC Training: Ops/Level 1 Maintenance	2/11/02 – 2/22/02
WSC Training: Level 2	2/25/02 – 3/15/02
GRGT Training	3/7/02 – 3/13/02

3. INTEGRATED LOGISTICS SUPPORT APPROACH

ILS implementation encompasses a variety of logistical elements that include maintenance planning, sparing, equipment replenishment, and reporting.

3.1 DAS PRODUCT LINE REPLACEABLE UNITS

Product Line Replaceable Units (LRUs) include rack-mounted equipment drawers and panels and other assemblies that can be removed by unplugging power and signal connectors without physically disturbing other LRUs. An LRU is defined as a piece of equipment, which can be replaced on-site to return the system to its operational capability. Other line replaceable items include printed circuit cards and other plug-in components within an LRU. An LRU listing, detailing redundant and hot-swappable LRUs, is provided in Table 3-1. Redundant equipment items are items for which there is a commanded switch-over should the item of equipment fail. Hot Swappable equipment items are those items that can be switched out by an operator without impacting operations. The final LRU listing will be provided prior to the Test Readiness Review (TRR).

Table 3-1: DAS LRU Listing

Configuration Item	Line Replaceable Unit*	
EMC Interface	• Control Processor • Fiber Optic Switch • Fan • Power Supply ®	• Common Data Broadcast • NTS Chassis • Serial Port Card
IBUG ®	• Control Processor • IBU Card ® • Power Supply ®	• Fiber Channel Receiver Card • Chassis • Fan
IF Switch	• IF Switch	
DMG ®	• Control Processor • Chassis • Fan	• DMU Card ® • Power Supply ®
Frequency and Timing	• Pulse Distribution Assembly	• Switch and Distribution Unit
ICON	• Server Assembly • Ethernet Hub	• Power Supply ®
DCON	• Server Assembly • Ethernet Hub	• Power Supply ®
DASCON	• Server Assembly • Power Supply ®	• RAID 1 Drive ® • Ethernet Hub
Data Archive/Server	• Server Assembly • Power Supply ®	• RAID 1 Drive ® • Ethernet Switch
Mechanical and Power	• Temperature Monitor	
* ® = Redundant = Hot Swappable		

3.2 LOGISTICS SUPPORT PROCESS

The following sections describe the process to be used to ensure availability and timely repair or replacement of failed hardware.

3.2.1 Maintenance Levels

The objective of the maintenance functions is to support achievement of the required inherent and operational availabilities of the system. General requirements, which directly affect the performance of maintenance functions, include ease of access to equipment for tests and maintenance, the use of built-in test and diagnostic features, and the capability to perform maintenance without interfering with on-going operations.

Software maintenance is provided according to NASA ground station policy to accept a full delivery (i.e., source code and supporting documentation) of all software. The Software Maintenance and Test Facility (SMTF) will maintain and provide software updates, as required.

Hardware maintenance will be conducted at two levels. First level maintenance is conducted to support the inherent availability requirements by timely replacement of line replaceable units (LRUs) and line replaceable items within LRUs. Second level maintenance consists of the repair, adjustment, and testing of LRUs removed from service during first level maintenance actions. Attention will be given to GSFC specifications so as to provide for chassis slides, cable service loops, and cable retractors to aid maintenance.

3.2.1.1 First Level Maintenance

First level maintenance includes scheduled preventive maintenance and fault isolating to the level of an LRU. Fault isolation to the level of a line replaceable item within an LRU (if any) shall be performed if the time required is consistent with the operational maintainability requirement. First level maintenance shall include replacement of a failed LRU or line replaceable element within an LRU. First level maintenance shall include testing to ensure that the system/subsystem has been restored to operational condition. First level maintenance shall include alignment and tuning.

3.2.1.2 Second Level Maintenance

Second level maintenance is conducted to restore malfunctioning equipment to serviceable condition when the failure requires unit/element disassembly. Second level maintenance is also required when the fault isolation capabilities of first level maintenance are incapable of localizing a failure to a line replaceable item within an LRU. Second level maintenance is performed in or under the management control of the WSC Depot Hardware Repair Facility.

Second level maintenance actions shall include localization of a failure to the piece-part or equipment component level, as appropriate. Second level maintenance actions shall include disassembly and removal of the failed piece-part or equipment component. Second level maintenance actions shall include replacement of failed elements and reassembly. Second level maintenance actions shall include bench testing to ensure performance to the specified level, and retest/calibration of the chassis/board/module. Second level maintenance requires designated facilities, comprehensive support and test equipment and personnel with specialized training and experience.

3.2.2 Maintenance Concept

Logistics support will include Levels 1 and 2 maintenance and disposal/replenishment activities. Personnel from WSGT, GRGT, vendor organizations and NASA will each play a part in implementing a life-cycle approach for identifying, repairing, replenishing and disposing of DAS component parts. Figure 3-1 provides the maintenance concept for DAS failed components.

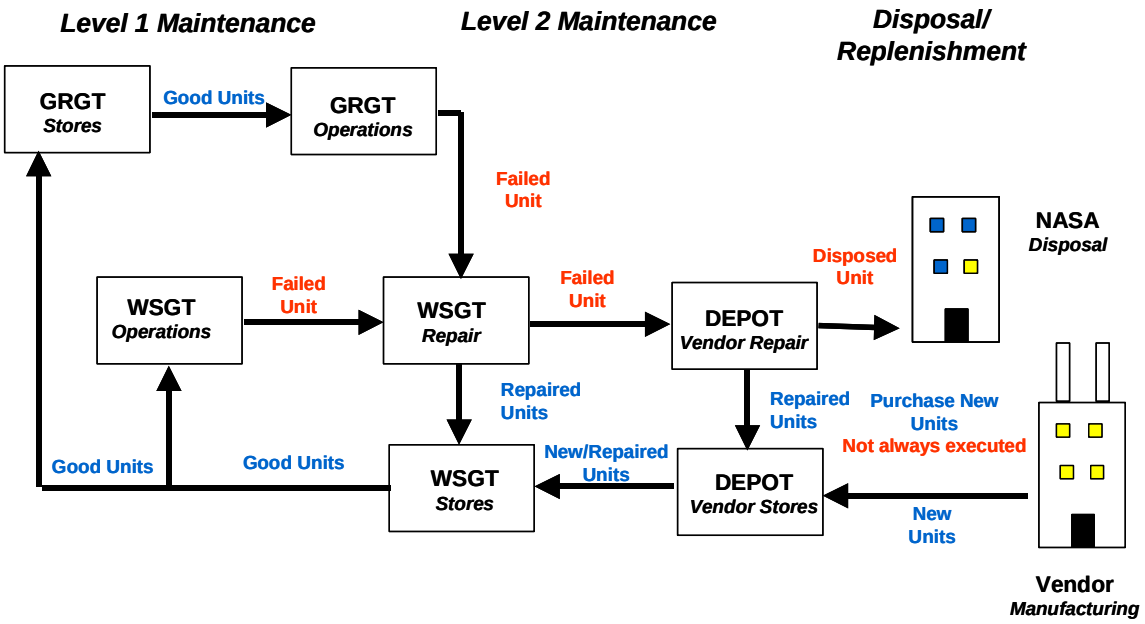

Figure 3-1: DAS Logistics Support Lifecycle

WSGT consists of operations, repair and the storage facility for DAS spares. When WSGT Operations experiences a fault, the failed part is forwarded to the WSGT Repair facility according to Level 1 Maintenance procedures. A new/refurbished part is procured from the WSGT Stores as a replacement. The WSC Station Director (STADIR) will direct the replenishment of operational site spares either by issue of an LRU from the WSC inventory or a repaired/refurbished LRU from the maintenance facility. If the failed part can be repaired, it is accomplished at the WSGT Repair Facility in accordance with Level 2 Maintenance procedures and forwarded to the WSGT stores. If the failed part cannot be repaired

by the WSGT Repair facility, it may be forwarded to a vendor for repair. A new/refurbished part may also be requisitioned from the vendor stores as a replacement.

The vendor depot logistics support process is governed by their own internal procedures.

The logistics support process for parts at GRGT works similarly to WSGT, except that GRGT does not contain a Level 2 Maintenance repair facility. When GRGT Operations experiences a fault, the failed part is forwarded to the WSGT Repair Facility unless it can be readily repaired under the limited reserves at GRGT. A new/refurbished part is obtained from the GRGT Stores as a replacement. WSGT Stores has the responsibility to replenish parts to the GRGT Stores on an as needed basis.

All parts delivered to and from each facility (e.g. WSGT, GRGT, vendor and NASA) must comply with the Packaging, Handling, Storage and Transportation requirements established in GPG 6400.1B.

3.2.3 Parts Disposal and Replenishment

Parts disposal includes actions to permanently discard components that are no longer repairable. NASA is the approval authority for designating failed parts for disposal. Once approval has been granted, vendor or NASA will dispose of the failed parts in an environmentally safe manner, and in accordance with Local, State, and Federal laws.

For each part disposed, NASA typically forwards a purchase order request to vendor manufacturing for a replacement. The Vendor is responsible for fulfilling the order in accordance with normal repair/replacement procedures. The Vendor will acknowledge to NASA completion of the purchase order and status of their stores on a periodic basis. Replenishment spares will be procured by NASA and supported by the O&M and Logistics Support Depot contractors.

4. RELIABILITY/ AVAILABILITY/MAINTAINABILITY REQUIREMENTS

4.1 OPERATIONAL REQUIREMENTS

The operational scenario calls for DAS to be in continuous operation 24 hours per day, 365 days per year with minimal downtime, consistent with the availability requirements specified in Section 4.4. DAS is to be operational for a minimum of 10 years. The Reliability, Maintainability and Availability (RMA) of the DAS is integral to successful mission accomplishment.

4.2 RELIABILITY

The reliability of DAS is a function of the system design. The reliability is stated in terms of Mean Time Between Failures (MTBF) parameters. When available, Reliability predictions for DAS equipment have been estimated utilizing data that has been collected from the Original Equipment Manufacturer, or the implementation contractor. MTBF prediction hours for each DAS CI are contained in the RMA Analysis Report (DRL No. 16).

4.3 MAINTAINABILITY

The maintainability of DAS is a function of the equipment design. The DAS equipment configuration is modular and will facilitate ease of access for maintenance actions for the removal and replacement of LRUs. DAS equipment/components will be labeled for ease of identification during maintenance actions. The maintainability requirement is stated in terms of the Mean Time To Repair (MTTR) parameters. MTTR data for each DAS CI is contained in the RMA Analysis Report (DRL No. 16).

4.4 AVAILABILITY

DAS SRD requirements specify an inherent availability of 0.995 and an operational availability of 0.9999. Based on the results of the availability analysis provided in the RMA Analysis Report, Table 4-1 shows that inherent availability requirements are exceeded, and the operational availability at GRGT is met. WSGT will meet the required operational availability with any one of the recommended design changes provided in the RMA Analysis Report.

Table 4-1: DAS Availability Requirements and Prediction Results

Availability	Requirement	WSGT	GRGT
Inherent	0.995	0.9996	0.9997
Operational	0.9999	0.9998	0.9999

5. SPARES ANALYSIS AND SPARES LISTS

5.1 SPARES DETERMINATION

Sparing quantities and locations were determined by reviewing the DAS RMA Initial Prediction for failure rates and repair times, and by considering similar systems currently in field use. Factors considered in evaluating spares quantities and locations include: Mean Time Between Failure (MTBF) and Mean Time to Repair (MTTR) for each LRU, Level 2 repair times from similar systems, the number of times any particular LRU can be repaired, cost effectiveness, and location.

Based on these preliminary factors, an LRU spares determination equation was developed. A failure time was first derived from the MTBF and number of LRUs required in DAS as follows:

$$T_F = \frac{MTBF}{Q_{LRU}} \text{ where}$$

T_F = Failure Time
Q_{LRU} = Quantity of LRU required in DAS
MTBF = Mean Time Between Failure of the LRU

The failure time was used to obtain a 'Failure Quantity' to express the number of failures that are expected over the 10-year life span of DAS. The Failure Quantity of the LRU is expressed as:

$$Q_F = \frac{LE}{T_F} \text{ where}$$

Q_F = Failure Quantity
LE = Life Expectancy = 10 years = 87, 600 hours
T_F = Failure Time

Next, the Failure Quantity was used to obtain a total quantity of LRU units based on the number of times the LRU can be repaired. It was assumed that any particular LRU can be repaired a maximum of 2 times before it is disposed. The total quantity of LRUs is expressed as:

$$Q_T = \frac{Q_F}{RL} \text{ where}$$

Q_T = Total Quantity of individual LRUs
Q_F = Failure Quantity of the LRU
RL = Repair Limit = 2 times

Finally, the Spare Quantity is obtained by subtracting the Total Quantity from the Failure Quantity, or

$$Q_S = Q_T - Q_{LRU}$$

Combining the above expressions, substituting constants, and solving for the Spare Quantity yields the following formula:

$$Q_S = Q_{LRU} * \left(\frac{43{,}800}{MTBF} - 1 \right)$$

Spare Quantity values were calculated for each LRU in the DAS system, and rounded to the next highest whole number (e.g. 1.23 = 2 LRUs).

The list of spare quantities was then adjusted according to the Level 2 maintenance repair time. An LRU spare was added if the repair time exceeded the time between the next projected failure.

Finally, spares were allocated to WSGT, GRGT and vendor/Depot sites using Table 5-1 and according to a variety of factors, including cost, shipping, repair time, and criticality.

Table 5-1: Spare Quantity Allocation Guidelines

Spare Quantity Value	Spare Allocation
< 1	1 Spare at WSGT Stores
2	1 Spare at both WSGT and GRGT Stores
3 – 8	x/2 Spares at both WSGT and GRGT Stores
> 8	4 Spares at both WSGT and GRGT Stores, remainder at Depot

5.2 SPARES LIST

5.2.1 General

Supply support to DAS will be established and maintained utilizing existing sources of supply with minimal augmentation. The Space Network Logistics manual, STDN 507 outlines basic supply accounting procedures, a standardized supply system, and a single point of reference for Operations and Maintenance (O&M) personnel requiring logistics support. These procedures apply to requesting, receiving, stocking, issuing, inventorying, and shipping material. The provision of replenishment requirements to support the operations and maintenance of the DAS will be the responsibility of the WSC. Whenever practical and cost effective, the WSC will utilize the Logistics Support Depot (LSD) to manage drop shipment or near-site blanket purchase order techniques to minimize the requirements to process material through either the WSC or LSD facilities. The LSD acts as the primary supply management interface with the WSC.

5.2.2 Provisioning Support

The provisioning support to the DAS will provide the spares required to ensure that DAS is fully supported during the first ten years of service. A provisioning conference will review the implementation contractor's recommended provisioning list for approval of the recommended selection of spares.

5.2.3 Spares Lists

Tables 5-2 and 5-3 provide initial and final spares lists for each LRU, calculated as follows:

1. The Initial Spares List (Table 5-2) provides spares for three IBUGs (two at WSGT and one at GRGT) and for two DMGs (one each at WSGT and GRGT).
2. The Final Spares List (Table 5-3) provides spares for 10 IBUGS and eight DMGs at both WSGT and GRGT.

Spares for intermediate configurations may be calculated by interpolation.

Table 5-2: DAS Initial Spares List

(For initial operating condition only.)

CI LRU	Red. x of y	LRU Quantity	MTBF (hours)	Calculated Spare Quantity (Q_S)	Adjusted Spare Quantity (Q_T)	WSGT Stores	GRGT Stores	Depot
Beamformer (IBUG) CI	3							
Control Processor	1 1	3	190,500	-2.3	**1**	1		
IBU Card	6 6	18	56,547	-4.1	**1**	1		
Fiber Channel Receiver Card	1 1	6	88,313	-3.0	**1**	1		
Chassis	1 1	3	111,212	-1.8	**1**	1		
Power Supply	1 2	6	110,257	-3.6	**1**	1		
Fan	1 1	3	31,464	1.2	**2**	1	1	
Demodulator Group (DMG) CI	2							
CP	1 1	2	190,500	-1.5	**1**	1		
DMU Card	8 8	16	38,825	2.1	**3**	2	1	
Chassis	1 1	2	85,372	-1.0	**1**	1		
Power Supply	1 2	4	110,257	-2.4	**1**	1		
Fan	1 1	2	31,464	0.8	**1**	1	1	
EMC Interface CI	1 1							
CDB Switch	1 1	1	304,182	-0.9	**1**	1		
Power Supply Assembly	1 2	2	110,257	-1.2	**1**	1		
Fan Assembly	1 1	1	25,000	0.8	**1**	1		
Serial Port Card	1 1	1	166,667	-0.7	**1**	1		
Control Processor	1 1	1	190,500	-0.8	**1**	1		
Fiber Optic Switch	2 2	2	14,854	3.9	**4**	4		
Frequency and Timing CI	1 1							
Switch and Distribution Unit	1 1	2	282,461	-1.7	**1**	1		
Pulse Distribution Assembly	1 1	2	50,000	-0.2	**1**	1		
IF Switch CI	1 1							
IF Switch	1 1	2	125,000	-1.3	**1**	1		
IBUG Controller (ICON) CI	1 1							
450 MHz Server Assembly								
Computer	1 1	2	17,646	3.0	**3**	1	1	1
Power Supply	1 2	4	200,000	-3.1	**1**	1		
Ethernet Hub (FastHub 412)	1 1	2	244,007	-1.6	**1**	1		
Demodulator Controller (DCON) CI	1 1							
450 MHz Server Assembly								
Computer	1 1	2	17,646	3.0	**3**	1	1	1
Power Supply	1 2	4	200,000	-3.1	**1**	1		
Ethernet Hub (FastHub 412)	1 1	2	244,007	-1.6	**1**	1		
DAS Controller (DASCON) CI	1 1							
600 MHz Server Assembly								
Computer	1 1	1	16,620	1.6	**2**	2		
RAID 1 Drive	1 2	2	400,000	-1.8	**1**	1		
Power Supply	1 2	2	200,000	-1.6	**1**	1		
Ethernet Hub (FastHub 412)	1 1	1	244,007	-0.8	**1**	1		
Data Formatter/Archive Server CI	1 1							
600 MHz Server Assembly								
Computer	1 1	2	16,620	3.3	**4**	2	2	
RAID 1 Drive	1 2	4	400,000	-3.6	**1**	1		
Power Supply	1 2	4	200,000	-3.1	**1**	1		
Ethernet Switch (24-port Switch)	1 1	2	304,182	-1.7	**1**	1		
Mechanical and Power CI	1 1							
Temperature Monitor	1 1	2	435,000	-1.8	**1**	1		

Planning assumptions:
1) Initial DAS configuration consists of three IBUGs (two at WSGT and one at GRGT) and two DMGs
2) LRU Quantity includes combined quantities of GRGT and WSGT (GRGT does not have EMC Interface or DASCON)
3) For calculated spare quantities less than zero, one spare is required.

Table 5-3: DAS Final Spares List

CI LRU	Red. x of y	LRU Quantity	MTBF (hours)	Calculated Spare Quantity (Q_S)	Adjusted Spare Quantity (Q_T)	WSGT Stores	GRGT Stores	Depot
Beamformer (IBUG) CI	20							
Control Processor	1 1	20	190,500	-15.4	**1**	1		
IBU Card	6 6	120	56,547	-27.1	**1**	1		
Fiber Channel Receiver Card	1 1	40	88,313	-20.2	**1**	1		
Chassis	1 1	20	111,212	-12.1	**1**	1		
Power Supply	1 2	40	110,257	-24.1	**1**	1		
Fan	1 1	20	31,464	7.8	**8**	4	4	
Demodulator Group (DMG) CI	16							
CP	1 1	16	190,500	-12.3	**1**	1		
DMU Card	8 8	128	38,825	16.4	**17**	4	4	9
Chassis	1 1	16	85,372	-7.8	**1**	1		
Power Supply	1 2	32	110,257	-19.3	**1**	1		
Fan	1 1	16	31,464	6.3	**7**	4	3	
EMC Interface CI	1 1							
CDB Switch	1 1	1	304,182	-0.9	**1**	1		
Power Supply Assembly	1 2	2	110,257	-1.2	**1**	1		
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Frequency and Timing CI	1 1							
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Mechanical and Power CI	1 1							
Temperature Monitor	1 1	2	435,000	-1.8	**1**	1		

Planning Assumptions:
1) Final DAS configuration consists of 10 IBUGs and eight DMGs at both WSC and GRGT.
2) LRU Quantity includes combined quantities of GRGT and WSGT (GRGT does not have EMC Interface or DASCON)
3) For calculated spare quantities less than zero, one spare is required.

6. TECHNICAL DATA AND DOCUMENTATION

Comprehensive Technical Data & Documentation (TD&D) is essential to ensure the effective operation and maintenance of das. TD&D will be required to establish and support maintenance procedures, provide information for maintenance analysis and planning, identification and procurement of spare and repair parts and identify project cost drivers.

TD&D requirements for effective life cycle maintenance and operations include, but are not limited to:

a. Performance and equipment specifications
b. Maintenance and operations manuals
c. Equipment manufacturer/vendor training documentation
d. Software source coding
e. Engineering drawings

TD&D obtained as part of DAS acquisition process will, wherever possible, be in an electronic transferable data package in American National Standard Code for Information Interchange (ASCII) format. Wherever possible and cost effective, the format will be in accordance with Technical Information Program (TIP) requirements for compatibility of information exchange. Access to technical data rights should be sought from the COTS equipment OEMs as part of the acquisition process. Such information/data is essential to ensure that firmware coding, technical drawings and other information will be available to support DAS operations should the OEM cease support of an equipment.

7. PACKAGING, HANDLING STORAGE AND TRANSPORTATION

7.1 REQUIREMENTS

NHB 6000.1D, NASA Requirements for Packaging, Handling and Transportation, establishes general requirements for preservation, packaging marking, handling, transportation and related data and documentation pertaining to all NASA procured software and hardware items. Standard practice for static packaging shall be applied for the protection of custom Application Specific Integrated Circuits (ASIC), programmable memories and circuit card assemblies being stored or being processed as new or replacement item from a maintenance action. The acquisition process has established that the packaging for all COTS equipment will comply with NHB standards, STDN specifications with STGT accepted deviations, or best commercial packing standard to ensure equipment will withstand transportation stresses for temperature humidity and altitude for road, sea and air shipment. Parameters include:

a. Temperature: -20°F to +160°F
b. Humidity Range: 0 to 100 percent
c. Altitude: sea level to 40,000 feet

7.2 TRANSPORTATION

The Government will accept DAS equipment at the implementation contractor's facility. Shipment of DAS assets is anticipated to be arranged by the O&M contractor direct to the WSC for integration and testing. Upon completion of factory acceptance testing of the WSGT and GRGT equipment, equipment will be air freighted to the WSGT and GRGT for installation.

ABBREVIATIONS AND ACRONYMS

ASIC	Application Specific Integrated Circuits
ASCII	American National Standard Code for Information Interchange
CDB	Common Data Broadcast
CI	Configuration Item
COTS	Contractor Off The Shelf
CSOC	Consolidated Space Operations Center
DAS	Demand Access System
DIDs	Data Item Description
DMG	Demodulator Group
DRL	Data Requirements List
EMC	Element Multiplexer Correlator
GRGT	Guam Remote Ground Terminal
GSFC	Goddard Space Flight Center
IBU	Independent Beamformer Units
IBUG	Independent Beamformer Unit Groups
ICD	Interface Control Document
ICON	IBUG Controller
ILS	Integrated Logistics Support
ILSP	Integrated Logistics Support Plan
LRUs	Line Replaceable Units
LSD	Logistics Support Depot
MAR	Multiple Access Return
MHz	Mega Hertz
MIL-HDBK	Military Handbook
MIL-STD	Military Standard
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
NASA	National Aeronautics and Space Administration
NHB	NASA Handbook
O&M	Operations and Maintenance
OEMs	Original Equipment Manufacturer

RMA	Reliability, Maintainability and Availability
SMTF	Software Maintenance and Test Facility
SN	Space Network
SRD	System Requirements Document
STADIR	Station Director
STDN	Space Flight Tracking and Data Network
STGT	Second TDRSS Ground Terminal
SWSI	Space Network Web Based Services Interface
TD&D	Technical Data & Documentation
TDRS	Tracking and Data Relay Satellite
TDRSS	Tracking and Data Relay Satellite System
TGBFS	Third Generation Beamforming System
TIP	Technical Information Program
TRR	Test Readiness Review
WSC	White Sands Complex (which consists of STGT, WSGT, and GRGT)
WSGT	White Sands Ground Terminal